Do R&D tax incentives lead to higher wages for R&D workers? : evidence from the Netherlands

Working Paper Series

#2012-058

Do R&D tax incentives lead to higher wages for R&D workers? Evidence from the Netherlands

Boris Lokshin and Pierre Mohnen

This working paper is a revised version of #2008-034

Maastricht Economic and social Research institute on Innovation and Technology (UNU-MERIT)
email: info@merit.unu.edu | website: http://www.merit.unu.edu

Maastricht Graduate School of Governance (MGSoG)
email: info-governance@maastrichtuniversity.nl | website: http://mgsog.merit.unu.edu

Keizer Karelplein 19, 6211 TC Maastricht, The Netherlands
Tel: (31) (43) 388 4400, Fax: (31) (43) 388 4499

UNU-MERIT Working Papers

ISSN 1871-9872

Maastricht Economic and social Research Institute on Innovation and Technology, UNU-MERIT

Maastricht Graduate School of Governance MGSoG

UNU-MERIT Working Papers intend to disseminate preliminary results of research carried out at UNU-MERIT and MGSoG to stimulate discussion on the issues raised.

Do R&D tax incentives lead to higher wages for R&D workers? Evidence from the Netherlands

Boris Lokshin
University of Maastricht
P.O. Box 616, 6200 MD, Maastricht, The Netherlands
(Corresponding author: Tel +31-43-3883551)
b.lokshin@maastrichtuniversity.nl

and

Pierre Mohnen
University of Maastricht, UNU-MERIT and CIRANO
P.O. Box 616, 6200 MD, Maastricht, The Netherlands
p.mohnen@ maastrichtuniversity.nl

July 18, 2012

Abstract

This paper examines the impact of the Dutch R&D tax incentive scheme on the wages of R&D workers. We construct firm specific R&D tax credit rates that vary over time following variations in the Dutch R&D tax incentive program. Using instrumental variables we estimate a wage-sharing model with an unbalanced firm-level panel data covering the period 1997-2004. The elasticity of the R&D wage with respect to the fraction of the wage supported by the fiscal incentives scheme is estimated at 0.2 in the short run and 0.24 in the long run.

Keywords: R&D wages; tax incentives;

JEL Classification: O32, O38, H25, J30, C23

Acknowledgement: The analysis for this paper was produced in part within the project "Evaluation of WBSO: Effects, coverage and execution", commissioned by the Ministry of Economic Affairs of the Netherlands, and in part within the SCIFI-GLOW Collaborative Project supported by the European Commission's Seventh Framework Programme for Research and Technological Development, under the Socio-economic Sciences and Humanities theme (Contract no. SSH7-CT-2008-217436).This paper represents the personal views of the authors, and not necessarily those of the Dutch Ministry of Economic Affairs. The authors also wish to thank the members of the feedback group of the Ministry of Economic Affairs, two anonymous referees, Bronwyn Hall, Jacques Mairesse, Timothy Simcoe, discussants at IIOC 2009 conference, and participants at the EARIE conference in Ljubljana for their critical comments.

1. Introduction

Most OECD countries dedicate significant resources to support private R&D. Two main policy instruments are used for this: direct subsidies and tax incentives. R&D tax incentives seem to have gained in popularity recently. For instance, in 1996, 12 OECD countries offered R&D tax incentives, while in 2008 this number increased to 21 (OECD, 2009). This increase is partly due to the fact that the policy of fiscal incentives is more neutral compared to direct subsidies, in principle offering a tax relief to any eligible R&D expenditure.

The usefulness of R&D support programs in general has been traditionally challenged for two reasons: government supported R&D may crowd out private R&D funding or get dissipated in higher R&D wages instead of stimulating real private R&D spending. Many empirical studies have examined the first question and often concluded that there is some additionality, in the sense that firms increase their R&D spending by more than the money they get from government in support of R&D (see Arundel et al., 2008; David, Hall and Toole 2000; Hall, 2002; Hall and Van Reenen, 2000 for reviews of empirical studies).

Surprisingly, the other key question, whether and to what extent government R&D support efforts dissipate into higher R&D wages as opposed to creating a R&D quantity effect, has remained largely unexplored. A number of papers on the effectiveness of R&D support programs have included a price effect in their analysis (e.g., Aerts, 2008; Lelarge, 2009; Haegeland and Møen, 2007; Reinthaler and Wolff, 2004), but most of these studies are concerned with direct R&D subsidies and not R&D fiscal incentives. Studies in labor economics have examined the effect of firm and employee characteristics on wages in general (e.g., Dobbelaere, 2004; Veugelers, 1989) but not specifically on the wages of R&D workers.

The contribution of this paper is to examine the magnitude of the effect of the Dutch R&D tax incentive program, known as WBSO[1], on the wages of R&D workers. By studying the price effect of the R&D fiscal incentive program, we seek to contribute to the policy discussion on the effectiveness of R&D support. We borrow from the stream of literature in labor economics to inform us on the specification of the wage equation. In our empirical analysis we use an unbalanced firm-level panel dataset constructed from the annual R&D surveys and production statistics from the Central Bureau of Statistics of the Netherlands. The richness of the merged dataset allows us to construct detailed R&D tax disbursement as a function of R&D tax incentives, providing sufficient variation in both the cross-section and time dimensions to identify the effects of the tax incentive program on R&D wages.

Our main empirical finding is that there is a significant price effect of the R&D tax incentive program on the wages of R&D workers in Dutch firms. After allowing for individual heterogeneity, business cycle fluctuations and the endogeneity of R&D tax credits we obtain estimates of the elasticity of R&D wages with respect to tax disbursements that are significantly different from zero. The point estimates of this elasticity range from 19% to 24% depending on whether static or dynamic models, short-run or long-run estimates are considered.

The remainder of the paper is organized as follows. Section 2 provides an overview of the theoretical and empirical literature on wage determination and government R&D support. Section 3 lays out our empirical model relating wages to R&D tax incentives, describes our data set and explains how we constructed the variables used in the empirical analysis. Section 4 presents the empirical results and section 5 summarizes and concludes.

---

[1] WBSO stands for "**W**et **B**evordering **S**peur- en **O**ntwikkelingswerk", in full "Wet Vermindering Afdracht Loonbelasting en Premie Volksverzekering, Onderdeel Speur- en Ontwikkelingswerk" (see de Jong and Verhoeven (2007)), which translating literally means "Law for lowering wage taxes and social security contributions related to R&D activities". This Research and Development (R&D) Tax Credit Act provides fiscal incentives for companies, knowledge centers and self-employed persons who perform R&D work.

2. Previous literature

In this section, we briefly review the empirical literature on wage determination and the one on R&D government support. Empirical studies on the effectiveness of direct and indirect R&D support aim at finding out whether firms substitute private R&D financing by direct aid or tax support, i.e. whether there is additionality or crowding out. The literature largely abstracted from the question of how much of the additional R&D is due to a volume effect and how much is due to a wage effect.

Empirical studies that examine the price effects of government support programs are still scant. Reinthaler and Wolff (2008) on a panel of 15 OECD countries, Ali-Yrrkö (2005) for Finland, Üçdoğruk (2004) for Turkey, and Aerts (2008) for Flanders find evidence of a positive effect of direct R&D subsidies on R&D wages. As Aerts (2008) argues, this wage effect could be the result of an inelastic supply of R&D employees or the result of a skill upgrading, skilled workers earning higher wages than unskilled workers. The wage effect could even be higher for tax incentives that are based on R&D labor costs (as in the Netherlands), if firms try to maximize on R&D tax credits. Lelarge (2009) concludes for France that the Young Innovative Firms Program (JEI, "Jeunes Entreprises Innovantes"), which consists in payroll tax cuts for R&D workers in newly created SMEs, has a six times larger effect on wages than the conventional R&D tax credits. She explains this finding by the fact that young firms are more dynamic than other R&D-performing firms, and use these payroll tax rebates to retain their high-skilled researchers.

Goolsbee (1997) is the first to have examined the price effects of tax incentives but in the context of physical capital investment. He argues that the low price elasticities of physical investment that are often found in empirical research can be explained by the fact that the short-run increased investment induced by tax incentives is mainly due to increases in the price of capital goods rather than to increases in the quantity of investment. According to his estimates a 10% investment tax credit can increase the price of equipment by as much as 3.5% to 7% in the short run. The inelastic supply of R&D workers, which increases their leverage in negotiated wage settlements, suggests that the wage effect of government R&D support can also be substantial. Goolsbee (1998) has shown that these R&D wage effects are sizable. Using Current Population Survey data he estimates that a 10% increase in total federal R&D expenditure leads to a 3% increase in the wages of R&D workers in the US. He concludes that the price effects limit the efficacy of government intervention to stimulate private R&D in the United States. Romer (2000) argues that the US should worry about the supply of scientists and engineers rather than merely creating more demand for R&D, for instance by granting R&D tax credits. He illustrates why the supply elasticity to rising wages for scientists and engineers is not very high and therefore why the increased R&D expenditure resulting from demand shifters for R&D may increase R&D wages and not just the volume of R&D.

Marey and Borghans (2000) apply a co-integration analysis using sectoral data for the Netherlands and report an average elasticity of R&D wages with respect to total R&D expenditures of 0.52 in the short run and 0.38 in the long run. Haegeland and Møen (2007) estimate on Norwegian firm data that per Euro of R&D tax credit 33 Eurocent go into higher average wages for R&D personnel and that the wage effect is characteristic of SMEs.

The empirical literature on wage determination in labor economics argues that wages are at least in part determined by the sharing in rents generated by efficiency wages, the employer's ability to pay, features of the product market, trade liberalization and technological innovations (e.g., Abowd and Lemieux, 1993; Blanchflower et al., 1996; Hildreth and Oswald, 1997; Krueger and Summers, 1988; Van Reenen, 1996; Veugelers, 1989). Assuming risk-neutral preferences on the part of the employees, a version of the following reduced-form equation for the real wage rate W is usually estimated:

$$W = f(R, \beta, \overline{w}, \mathbf{Z}) \qquad \partial f / \partial R > 0, \partial f / \partial \overline{w} > 0,\ 0 \leq \beta \leq 1, \tag{1}$$

where R is a measure of rents to be shared, $\overline{w}$ is the alternative wage, $\mathbf{Z}$ is the vector of controls, and parameter β ($0 \leq \beta \leq 1$) is the 'sharing' parameter to be estimated. It measures the fraction of the rent that accrues to workers in addition to their opportunity wage. If $\beta = 0$ the entire rent accrues to the firm. If, on the contrary, $\beta > 0$ 'sharing in rents' occurs that increases the wages[2].

Previous studies have considered different measures of rents, such as profits per employee (Arai, 2003; Blanchflower et al., 1996), value added per employee (Dobbelaere, 2004), and Tobin's Q (Salinger, 1984; Van Reenen, 1996). Parameter β, as explained, can be considered as a constant to be estimated, but it can also be made heterogeneous and modeled to depend on variables such as sectoral unemployment rates, the price index, proxies for product market concentration (e.g., Dobbelaere, 2004; Veugelers, 1989). Van Reenen (1996) attributes rents to firms' innovation output and R&D input.

In summary, the literature on R&D support acknowledges that part of the effect of R&D government programs may get dissipated in R&D wages. However, the empirical evidence on the magnitude of the wage effect is still scant. In what follows, we explain how we quantify the wage effect of an R&D tax incentive program. The literature on wage determination provides a useful modeling framework to estimate the magnitude of the wage effect.

[2] If $\beta = 1$ the worker would choose to set the wage rate equal to R/L, assuming the latter to be higher than the alternative wage.

3. Model and data

Our hypothesis is that the R&D tax credits received from government partly accrue to R&D workers in the form of higher wages. There are various ways to justify such a price effect. Firms may share the R&D tax credits with their R&D personnel by offering higher wages to encourage their R&D department to apply for R&D tax credits. It may also reflect imperfections in the labor market for scientists and engineers, an inelastic supply on that market, the existence of search costs for scientists and engineers or bargaining power of the latter. The point here is not that firms reduce their own R&D funding with government money (crowding out) but that the additional R&D expenditure is split into a quantity and a price effect. To test this hypothesis, we formulate an empirical specification of the wage of R&D workers that is partly determined by the R&D tax credits. We estimate the following equation for firm *i* at time *t*:

$$\ln W_{it} = \beta \ln d_{R,it} + \delta (K/L)_{it} + \gamma \ln Size_{it} + \varphi \ln \overline{w}_{jt} + \mathbf{d} Z_{jt} + \varepsilon_{it} \qquad (2)$$

where W is the R&D wage rate, d is a measure of the R&D tax credit received, K/L is the capital to labor ratio, size is measured in number of employees, $\overline{w}$ is the alternative wage (proxied by the average sector R&D wage rate in industry j to which firm i belongs), Z is a vector of control variables, and i, j and t are respectively firm, industry and time subscripts. The parameter of interest β is the price elasticity of R&D wage with respect to the R&D tax credit.

To allow for unobserved firm-level heterogeneity in wages across firms and for common macro-economic shocks, the error term ε_{it} in equation (2) includes a firm-specific effect μ_i, a year-specific intercept λ_t, in addition to a serially uncorrelated measurement error u_{it}:

$$\varepsilon_{it} = \lambda_t + \mu_i + u_{it} \qquad \text{for } i = 1,...,N\ ; t = 1,...,T_i\ .$$

The firm-specific effect can also be replaced by an industry specific effect ν_j , $j = 1,...,M.$, if heterogeneity is assumed to vary only across industries. Several studies have estimated a dynamic wage equation, with the lagged wage as an additional explanatory variable, justifying the persistence in wages by the slow adjustment of wages to external shocks (e.g., Hildreth and Oswald, 1997). Therefore, we have also estimated a dynamic version of equation (2), which yields both short- and long-run price effects. To estimate such a model we have used the more efficient system GMM estimator (Blundell and Bond, 1998).

We use two data sources both supplied by the Dutch Central Bureau of Statistics. The annual R&D surveys contain information on the type and the amount of R&D expenditure and the census data on production statistics contain information on output and labor, as well as sector output deflators. We merge the two data sources using a unique firm identification number. These data sources and the process of merging them are explained in detail in Lokshin and Mohnen (2007). In the estimation we use an unbalanced panel of annual firm data between 1997 and 2004.

In this study we estimate a price effect for R&D workers, i.e. for only a small subset of all employees. The average number of R&D workers per firm is about 24 in our sample. If we consider only full-time researchers (and omit research assistants) the mean is about 12 employees. In percentage terms R&D workers make up, on average in our sample, 7.8% of total employment in a firm (3.7% if we exclude research assistants). On average, across the years, the sector real R&D wage rate grew at 3.7% per annum, from an average of a little over 20 €/hour in 1997 to about 26 €/hour. The standard deviation of the average sector wage rate is about 3. It actually decreased over time in our sample, mainly because the sample composition tilted towards larger firms. The cross-sectional variation of the firm wage within sectors is large (average standard deviation of about 10) and accounts for most of the heterogeneity in wages.

The R&D tax incentive facility primarily targets small and medium sized enterprises. Firms from all manufacturing and service sectors can participate in the program. In 2004 there was the following distribution of firms by sector: agriculture (6%), food (5%), chemicals (12%), machines (28%), other manufacturing (23%), ICT (11%), and other services (14%). This distribution has stayed more or less constant from 1997 till 2004 (de Jong and Verhoeven, 2007).

In the empirical analysis the following industries are used with their standard industrial classification code (SBI) in parentheses: food, beverages and tobacco (15-16), textile, apparel and leather (17-19), paper and paper products (21), printing (22), oil (23), chemicals and pharmaceuticals (24), rubber products and plastics (25), non-metallic products (26), basic metals (27), fabricated metal products (28), machines and equipment (29), electrical products (30-33), motor vehicles (34-35), other manufacturing (36-37), construction (45), catering (50), wholesalers (50), retailers (52), communication (60-64), and business services (70-74).

For all size classes the coverage has gradually increased from the inception of the tax incentives program in 1994 to the last year of our sample 2004, both in terms of the number of firms applying and the number of total applications by these firms. From 1997 to 2004 there was a 29% increase in granted applications for the tax credits.

When we split the number of observations in our sample in three categories of firm size we see that the distribution of our sample across size classes remains stable over time: 12% have less than 50 employees, 62% have between 50 and 250 employees and 26% have over 250 employees.[3] According to SenterNovem, the administrative agency in charge of R&D tax incentives, 70% of the participating firms have less than 250 employees[4]. In our final sample the number of observations from firms in that size class is close to 75% of the total. Firms with fewer than 10 employees are not represented in our sample because the CBS does not collect data on these firms in their innovation and R&D surveys.

The R&D cost composition of firms in the sample stayed reasonably constant over time. For instance, the share of the labor component is approximately 75% and remained more or less unchanged in the time period in our sample.

Table 1 lists the main parameters of the fiscal incentives program for our sample period. For example, in the year 2004, there were two brackets: firms could deduct 42% of their R&D labor cost on the first 110 thousand Euros on R&D wage expenditure, followed by a 14% deduction rate on the remaining amount up to a ceiling of total R&D tax credits set at 7.9 million Euros. There have been a couple of changes over time in the length of the two brackets and the corresponding rates of R&D tax credits. For example, in 2001 the length of the first bracket was extended from € 68,067 to € 90,756 and in the same year a higher additional first-bracket tax credit for starters (60% as opposed to 40% for the rest) was introduced.

INSERT TABLE 1 HERE

[3] We selected only those firms that performed R&D on a continuous basis, the so called 'hard-core' R&D performers because in odd years the CBS only collects data for 'hard-core' R&D performers. Participation in the fiscal incentives program by the 'hard-core" R&D performers is very high, on average more than 95%. Therefore, we assume in our model that each firm eligible to participate in the tax incentives program makes use of it.

[4] The principal function of SenterNovem, now Agentschap.nl, is to process applications and to verify that the R&D projects submitted for approval conform to the regulations set for this R&D support scheme.

The dependent variable in our model, $\ln W_{it}$, is the logarithm of the real R&D wage rate measured as the total real R&D labor costs per R&D employee. The total wage bill and the number of R&D employees are taken from the R&D survey. Wages are expressed in real terms, i.e. R&D and its components are deflated by a weighted average composed for 50% of the GDP deflator and for 50% of the R&D wage deflator. A similar approach is taken by Bloom et al. (2002).

The key explanatory variable $d_{R,it}$ is a measure of the effective R&D tax credit rate that a firm can claim by participating in the fiscal incentives program. Using information about the R&D cost composition provided by the CBS and the parameters of the fiscal incentives scheme (see Table 1), for each firm and each year available in the sample we compute $d_{R,it}$ using expression A1 given in Appendix A. The expression for $d_{R,it}$ determines the average rate at which an R&D-performing firm can reduce its R&D labor costs by using the R&D tax incentives. We can use it to compute the amount of disbursement, in Euros, which a firm receives back from SenterNovem by simply multiplying $d_{R,it}$ by the firm's R&D wage bill.[5] The agency's decisions are taken to be completely exogenous in our model, as they are in practice. For identification purposes it is important that there be sufficient variation in $d_{R,it}$. Formula A1 indicates that this variation comes from several sources. First, there were a number of changes (taken to be exogenous) in the fiscal incentives scheme's parameters. Such changes, reported in Table 1, occurred in every year except one within our sample period. The first bracket threshold increased three times, the rate applied to the first bracket increased three times, the rate applied to the second bracket changed five times and the ceiling changed twice. Variation of $d_{R,it}$ in the cross-section comes from two sources.

[5] We implicitly assume that all R&D firms apply for R&D tax credits, and that the tax credits get paid the year in which the R&D costs are incurred.

First, the variation is determined by whether a firm applies for the standard or the preferential starter's rate. Second, the effective rate of R&D tax credit depends on how high a firm's R&D wage bill is. This potential source of endogeneity calls for an instrumental variable approach. We discuss estimation methods in the results section below.

In models of wage determination the equilibrium wage is determined by internal as well as external factors. The latter can be thought of as an opportunity cost or as the current wage in other sectors of the economy (e.g., Blanchflower, Oswald and Sanfey, 1996; Van Reenen, 1996). The importance of controlling for the alternative wage depends on the extent to which the skills of R&D workers are firm or industry specific, i.e. substitutability of R&D skills within or across industries. It could be set to zero, an approach taken by Vandenbussche et al. (2001). Ideally, it should reflect the marginal productivity of labor (MPL) prevailing in each industry. MPL is difficult to measure in practice and we therefore follow the example of Van Reenen (1996) and include average sector R&D wage as a proxy for alternative wage. Alternatively, we could interpret our results as a premium over the industry wage determined by an (inelastic) R&D labor supply curve.

Previous contributions found that wages are positively correlated with firm size and capital intensity. A positive effect of size on wages can arise as a result of collective wage bargaining at the industry level (Blanchflower et al., 1996; Forslund, 1994; Hildreth and Oswald, 1997; Holmlund and Zetterberg, 1991). Abowd, Kramarz and Margolis (1999) using a large employer-employee French panel dataset find that firms that pay higher wages are more capital intensive and productive. Given equal union status, several authors have found that there is a wage premium for workers employed by large firms. Large firms can enjoy more market power and be more successful in attracting higher-quality workers (Albaek et al., 1998; Melow, 1982; Brown and Medoff, 1989).

We include *K/L*, the capital-to-labor ratio, as a control variable. According to Bronars and Famulari (2001) complementarity between capital and skilled labor will lead capital intensive firms to hiring more skilled workers (with a higher productivity of labor). When labor costs are negligible vis-à-vis the cost of capital, employers' resistance to wage demand is expected to be smaller (Arai, 2003). According to the efficiency wage theory, a higher capital-labor ratio can also lead to an increase in the cost of production and prompt firms to accord a wage premium to encourage their employees to reduce costs by improving performance (e.g., Akerlof and Yellen, 1986).

To control for firm size we include *ln Size*, the logarithm of the firm's number of employees. Brown and Medoff (1989) offer several explanations rooted in 'compensating differentials' as well as institutional theory for the positive correlation between firm size and wage premium. These factors capture the desire of larger employers to 'follow a strategy of positive labor relations' as well as their advantage over smaller rivals in attracting higher labor quality.

Many studies have uncovered cyclicality of wages over the business cycle (see Abraham and Haltiwanger, 1995, for a review; Bils, 1985; Kean et al., 1988; Solon et al., 1994). Cyclical wage movements can be the result of technology shocks shifting short-run demand curves against fixed supply curves or of movements along a fixed short-run labor demand curve[6]. We include controls for business cycle influences on R&D investment by using industry-specific business cycle indicators: for investment potential (i.e. solvability and return on total assets) and indicators for perceived competition, turbulence and economic

[6] Bowlus et al. (2002) point out that this cyclical behavior of wages may be difficult to capture with aggregate data because of the potential compositional changes in a firm's employment over the business cycle. In our case, such compositional changes are likely to be limited because we look at a specific narrow subset of a firm's employment.

development. These time-varying business-cycle variables at the industry level are collected in vector **Z** in expression (2).

Table 2 provides descriptive statistics on the variables used in the estimation. A positive relationship is expected between the effective rate of R&D tax credit and the wage rate, if there is a price effect of the tax incentives program.

INSERT TABLE 2 HERE

4. Empirical results

In order to get a feeling of a possible effect of the Dutch R&D tax incentives on R&D wages, we estimated the dynamic factor demand model for R&D from Lokshin and Mohnen (2012), where the R&D investment was regressed on the user cost of R&D and other control variables, by replacing the R&D denominated in constant prices by the R&D in current prices. In the absence of a price effect, the elasticities of real and nominal R&D to variations in the user cost of R&D, generated by changes in the R&D tax incentives, should be the same. The effect of R&D tax incentives on nominal R&D (via changes in the user cost of R&D) can hence be decomposed into a price effect and a quantity effect. We obtain a nominal short-run elasticity of -0.45 and a nominal long-run elasticity of -0.83, both statistically significant. By comparing these nominal effects with the estimated real effects (short-run elasticity of -0.42 and long-run elasticity of -0.79), reported in Lokshin and Mohnen (2012, Table 4, last column), we arrive at a price effect of changes in the user cost of R&D of approximately 8% in the short run and 5% in the long run. On the basis of this result, we expect to uncover a positive price effect from R&D tax incentives from the estimation of our model specified in section 2, to which we now turn.

Table 3 reports the results of Equation (2). As a benchmark case, in column (1) we report the results from an OLS regression without firm-specific fixed effects but with industry dummies in which the R&D tax credit disbursement variable is treated as exogenous. The elasticity of the wage with respect to the effective R&D tax credit is rather small (0.06), yet statistically significant. In column (2) we report the results from an OLS regression with fixed firm-specific effects. The tax credit elasticity increases to 0.16 and becomes significant even at the 1% level. The individual effects are significantly different from zero. The Hausman test rejects the null hypothesis that the effective rate of R&D tax credit is exogenous ($\chi^2(1)$ of 8.91) and, therefore we proceed to an instrumental variable estimation.

INSERT TABLE 3 HERE

Column (3) reports the results of the IV estimation with firm fixed effects using the within transformation of the variables. The individual effects are treated as fixed as the Hausman test rejects the null hypothesis of orthogonality between the regressors and the individual effects ($\chi^2(16) = 29.39, p = 0.02$). In addition to the contemporaneous real R&D deflator, which varies only at the industry level, we construct the instrument for the tax rate variable using information on firm's R&D from a pre-sample period[7], i.e. we compute $d_{it}^{IVFE} = \left\{ min\left\{\frac{Threshold_t}{R\&D_{i1}}, 1\right\} \times Rate_t \right\}$ if firm i is eligible, and otherwise. We use d_{it}^{IVFE} and the R&D deflator as instruments for d_{it} and then conduct the fixed effects regressions using data from periods 2 to T.

We run a number of tests to check the validity of our instruments. First, we examined the fit of the first-stage regression, where the effective tax rate is regressed on all exogenous variables in the model including the excluded instrumental variables. The F-statistic, (F (17,

[7] We thank an anonymous reviewer for this suggestion.

2355) = 160.59) is higher than 10, satisfying the Staiger and Stock rule of thumb for non-weak instruments (see appendix B). Second, we estimated the reduced form of the wage equation, this time regressing the log of the wage rate on all exogenous variables. The two excluded instrumental variables are significant and have the expected sign. The effective tax rate constructed from pre-sample information is positive and the R&D deflator is negative, the former stimulating R&D and increasing the R&D wage rate, the latter decreasing R&D and the R&D wage rate (see appendix C). The rank test of under-identification rejects the null hypothesis that the matrix of reduced from coefficients has less than full rank and hence points to the relevance of the instruments and to the identification of the model with those instruments ($\chi^2(2) = 139.98$). The F-test based on Shea's partial R^2 of the first stage regression has a p-value lower than 0.01. We also checked the Cragg-Donald statistic to test whether the instruments are weak in terms of relative bias (the maximum relative squared bias of the IV estimator relative to the OLS estimator) and in terms of bias in the Wald test size (whether the actual size of the test is at least some value b above the nominal level of the test). The Stock and Yogo test (Stock and Yogo, 2005) rejects the null hypothesis that the instruments are weak allowing for a 10% distortion in the size of the Wald test using IV rather than OLS. Furthermore, the Sargan/Hansen test statistic is small (1.32, with a p-value of 0.25) and therefore does not reject the validity of the instruments. We also checked whether the capital-to-labor ratio variable is endogenous and needs to be instrumented. The obtained C-statistic (1.32, with a p-value of 0.24) is quite small, and therefore we cannot reject the null hypothesis of exogeneity of this variable.

We find that the tax credit elasticity increases slightly from 0.159 in column (2) to 0.21 in column (3) after instrumenting the R&D tax credit disbursements.

Among the control variables, the capital-to-labor ratio is not statistically significant in the fixed-effects IV version of the model, the firm size and the alternative wage variables are significant only at 10% when individual effects and the endogeneity of the tax credit are taken into account. Experiments with the quadratic terms of the capital-to-labor ratio and the firm size revealed that these coefficients are hardly significant. The business cycle variables are jointly significant in the estimation based on the within transformation of column (3).

Several experiments were carried out to check the robustness of the findings. To check for the effect of changes in a firm's employment structure, such as in its skill composition, as a result of tax credits, we estimated separate regression in which the ratio of the number of senior research staff to research assistants is the outcome variable. The tax credit variable was not found to be significant in this specification.[8] This finding is in line with our hypothesis that the tax credit dissipates primarily in rents for R&D workers and does not lead firms to change the composition in their R&D workers (such as substituting low-cost workers by high-cost workers).

Previous empirical studies report significant differences in the ability of specific groups of workers to command higher wages (e.g. Black and Strahan, 2001; Nekby, 2003). R&D intensity and R&D wages could be correlated if R&D workers - scientists and engineers and R&D supporting personnel - constitute a relatively important group of workers within a firm. According to Sap (1993) the relative importance of a group can under certain conditions determine the bargaining power of this group. A higher R&D intensity ratio captures to some extent the importance of R&D workers within a firm. We added as an additional control variable the firm's real, other-than-labor, R&D expenditures divided by total sales[9]. Controlling for the R&D intensity at the firm level could also be important if high-ability and

---

[8] We did this using the same specification as in equation (2), just replacing R&D wage by the R&D labor composition as the dependent variable, and by using the specification proposed in Lokshin and Mohnen (2012) to explain the demand for R&D, what appears to us as a more satisfactory specification for explaining the R&D labor composition. In none of the specification was the rate of R&D tax credit significant. The results are not presented here, but are available upon request.

[9] We used other-than-labor R&D expenditures to avoid an obvious correlation with the dependent variable. Other-than-labor R&D expenditures are sufficient to control for total R&D expenditure if the shares of R&D cost components are pretty much fixed.

consequently high-wage workers systematically "sort" out into more R&D intensive firms. The coefficient on R&D intensity was, however, not significant at the conventional levels of significance, suggesting that there is not systematic "sorting out".

Several previous studies have estimated a dynamic version of equation (2) justifying wage persistence by, for example, the slow adjustment of wages to external shocks (e.g., Hildreth and Oswald, 1997). We therefore also estimated a dynamic version of equation (2) by including a lagged wage term on the right-hand side. In a dynamic model the "within" estimator leads to inconsistent estimates. To overcome this problem we used the system GMM estimator (Blundell and Bond, 1998). The estimates from the dynamic model are presented in column (7) of Table 3. We used as instruments the two period lagged values of the wage rate and of the effective rate of R&D tax credit in addition to the contemporaneous values of the exogenous variables. The Sargan test of over-identifying restrictions does not reject the validity of the instruments (the p-value is 0.14). The Arellano-Bond auto-correlation (AR) test applied to the differenced residuals of the GMM estimation indicates that there is no serial correlation in the error terms as the AR(2) test is insignificant[10]. The estimated coefficient on the lagged wage variable is 0.21 (with a standard error of 0.05), suggesting that wages adjust by 80% to their desired level within one year. The R&D tax credit elasticity of the average R&D wage is estimated at 0.188 (with a standard error of 0.045). These values imply a statistically significant long-run elasticity of R&D wages with respect to the R&D tax credit rates of 0.24[11].

We conclude that R&D tax incentives get partly dissipated in wages for R&D workers instead of contributing to additional R&D. If we compare the 0.2 wage elasticity estimated

---

[10] We note that first-order autocorrelation, AR(1), in the differenced residuals occurs by construction.

[11] The long-term elasticity of wages with respect to the rate of R&D tax credit is computed, conventionally, as the short-run elasticity of wages with respect to that rate divided by one minus the coefficient on the lagged wage variable.

here to our 0.79 elasticity of R&D stock reported in Lokshin and Mohnen (2012), then we can say that the real effect of R&D tax incentives and the ensuing bang for the buck could be could be higher by a magnitude of 25%, if there was no wage effect.

5. Discussion and conclusions

This paper examines the price effect of the Dutch R&D tax incentive program aimed at stimulating R&D expenditures in business firms. Fiscal incentives are the main policy instrument in the Netherlands to promote R&D by granting firms deductions from their social security contributions proportionately to their annual R&D wage bill. A recent evaluation of the fiscal incentives program concluded that it was effective in stimulating business R&D (Lokshin and Mohnen, 2012). This paper provides micro-level econometric evidence that there is also a wage effect related to the R&D tax incentives program. Part of the R&D tax credits get transmitted into higher R&D wages because of inelastic labor supply, search costs for scientists and engineers, incentives given to R&D employees, or bargaining power of R&D employees.

To estimate the magnitude of the price elasticity we exploit a rich unbalanced firm-level panel data set covering the years 1997-2004. We estimate a model sharing-in model where the average R&D wage depends on the effective rate of R&D tax credit, the alternative industry wage, and several firm and industry specific control variables. We allow for individual heterogeneity, and we correct for the endogeneity of the effective rate of R&D tax credit and for the dynamic panel bias when we estimate a dynamic version of the model. The estimated elasticity of the average R&D wage with respect to the effective rate of R&D tax credit is significantly different from zero and of the order of 0.2, with little difference between the short-run and the long-run effect because the average wage adjusts quickly to its optimal value.

Our estimates of the wage effects are somewhat smaller than those found by Goolsbee (1998) for the U.S. and by Marey and Borghans (2000) for the Netherlands. This difference could be due to two reasons. First, the level of aggregation is different. Goolsbee (1998) works at the aggregate level and Marey and Borghans (2000) at the sector level. At a higher level of aggregation, spillovers are more likely to be present and produce extra pressure on the wage rates of R&D workers. The other reason is that we only consider R&D tax incentives and not total government R&D or total private and public R&D. Tax incentives are more neutral compared to direct R&D subsidies or R&D performed in government labs, which are more focused and may require a certain type of R&D workers with a relatively more inelastic supply. It is worth mentioning that our results of the price effect of R&D tax incentives are in line with the findings reported in the labor literature on wage determination. Hildreth and Oswald (1997) estimated an elasticity of wages with respect to profits per worker of about 4% using firm-level data. Abowd and Lemieux (1993) report an elasticity of about 20%. Van Reenen (1996) applied three different measures of rents created through product innovation (profits per head, Tobin's Q and the difference between real sales per worker and average industry wage) to examine the impact of innovation induced rents on wages on a panel of British firms. He reports an elasticity of wages to innovation rents of about 0.29 for the quasi-rent measure, 0.05 for the profits per head measure and 0.04 for Tobin's Q rent measure.

Our findings have a number of policy implications. The existence of a wage effect of R&D tax credits suggests that the efficiency of the R&D tax incentive program could be enhanced if the wage effect could be avoided. What goes into higher wages for scientists and engineers could go into more real expenditures on research and development. We estimate the wage effect to reduce the quantity effect and the effectiveness of R&D tax incentives by some

25 percent. On the other hand, higher wages might be the price to pay to retain high-skilled researchers with promising returns in the future.

There are a number of limitations in our approach. The model presented in this paper assumes a constant disbursement parameter across all R&D workers. A more refined analysis, which would allow this parameter to differ across R&D workers, could not be performed because of the lack of data on individual-specific wages. This issue could be addressed in the future when the Central Bureau of Statistics makes it possible to link firm and individual-specific data. Relying on aggregated firm data does not allow us to control for differences in R&D workers' characteristics such as seniority and schooling. Inability to control for individual worker characteristics amounts to an omitted variables bias (see Abowd et al., 1999, for discussion). The aggregation bias is mitigated if R&D incentives affect all R&D workers of a firm, which is the case in our data.

Other interesting avenues for future research are the comparison of the wage effects of different instruments for stimulating R&D, such as direct and indirect measures of support and the competition for R&D talent between countries. Other instruments, such as educational policies and open-emigration policies as a way to decrease the inelastic supply of talents are worth investigating but remain outside the scope of this paper.

References

Abowd, John A. and Thomas Lemieux. 1993. The effects of product market competition on collective bargaining agreements. *Quarterly Journal of Economics* 108 (November): 983-1014.

Abowd, John A., Francis Kramarz and David N. Margolis. 1999. High-wage workers and high-wage firms. *Econometrica* 67 (March): 251-333.

Abraham, Katharine and John Haltiwanger. 1995. Real wages and the business cycle. *Journal of Economic Literature* 33: 1215-1264.

Aerts, Kris. 2008. Who writes the pay slip? Do R&D subsidies merely increase researcher wages?, internal report K.U.Leuven, Faculty of Business and Economics.

Akerlof, George A., and Janet L. Yellen. 1986. *Efficiency wage models of the labor market*. Cambridge University Press.

Ali-Yrkkö, J., 2005. Impact of public R&D financing on employment. Discussion paper 980, The Research Institute of the Finnish Economy, Helsinki.

Arai, Mahmood. 2003. Wages, profits, and capital intensity: Evidence from matched worker-firm data. *Journal of Labor Economics* 21(3): 593-618.

Albaek, Karsten, Mahmood Arai, Rita Asplund, Erling Barth, Erik Strøjer Madsen. 1998. Measuring wage effects of plant size. *Labour Economics* 5: 425-48.

Arundel, Anthony, Catalina Bordoy, Pierre Mohnen and Keith Smith 2008. Innovation Surveys and Policy: Lessons from the CIS, in *Innovation Policy in Europe: Measurement and Strategy* (C. Nauwelaers and R. Wintjes, eds.), Elward Elgar, 2008.

Bils, Mark J. 1985. Real wages over the business cycle: evidence from panel data. *Journal of Political Economy* 93: 666-89.

Black, Sandra and Phillip Strahan. 2001. The division of spoils: rent sharing and discrimination in the regulated industry, *American Economic Review* 91: 814-31.

Blanchflower, David A., Andrew J. Oswald and Peter Sanfey. 1996. Wages, profits and rent-sharing. *Quarterly Journal of Economics* 111(1): 227-251.

Bloom, Nicolas, Rachel Griffith, and John Van Reenen 2002, Do R&D tax credits work? Evidence from a panel of countries 1979-1997, *Journal of Public Economics* 85, 1-31.

Blundell, Richard and Steve Bond 1998. Initial conditions and moment restrictions in dynamic panel data models, *Journal of Econometrics* 87: 115-143.

Bowlus, Audra, Haoming Liu, Chris Robinson. 2002. Business cycle models, aggregation and real wage cyclicality. *Journal of Labor Economics* 20(2): 308-35.

Bronars, Stephen and Melissa Famulari. 2001. Shareholder wealth and wages: evidence for white collar workers. *Journal of Political Economy*, 109: 328-54.

Brown, Charles and James L. Medoff. 1989. The employer-size-wage effect. *Journal of Political Economy*, 97: 1027-59.

David, Paul, Bronwyn H. Hall, and Andrew A.Toole, 2000. Is public R&D a complement or substitute for private R&D? A review of the econometric evidence, *Research Policy*, 29, 497-529.

de Jong, Jeroen and Verhoeven, Wim, 2007. WBSO evaluation 2001-2005: Impacts, target group reach and implementation, Research Series, Ministry of Economic Affairs, The Hague. Netherlands.

Dobbelaere, Sabien. 2004. Ownership, firm size and rent sharing in Bulgaria. *Labour Economics* 11(2): 165-89.

Forslund, Anders. 1994. Wage setting at the firm level: Insider versus outsider forces. *Oxford Economic Papers* 46: 245-61.

Goolsbee, Austan. 1997. Investment tax incentives, prices and the supply of capital goods. *Quarterly Journal of Economics* 113(1): 121-48.

Goolsbee, Austan. 1998. Does government R&D policy mainly benefit scientists and engineers? *American Economic Review* 88(2): 298-302.

Haegeland, Torbjørn and Jarle Møen. 2007, Input additionality in the Norwegian R&D tax credit scheme. report 2007/47, Statistics Norway.

Hall, Bronwyn. 2002. The financing of Research and Development, *Oxford Review of Economic Policy* 18(1): 35-51.

Hall, Bronwyn and John Van Reenen, 2000. How effective are fiscal incentives for R&D? A review of the evidence, *Research Policy* 29, 449-469.

Hildreth, Andrew K. G. and Andrew J. Oswald. 1997. Rent-sharing and wages: Evidence from company and establishment panels. *Journal of Labor Economics* 15(2): 318-37.

Holmund, Bertil and Johnny Zetterberg. 1991. Insider effects in wage determination. *European Economic Review* 35: 1009-34.

Kean, Michael; Robert Moffit and David Runkle. 1988. Real wages over the business cycle: estimating the impact of heterogeneity with micro data. *Journal of Political Economy* 96: 1232-66.

Krueger, Alan and Lawrence Summers. 1988. Efficiency wages and the inter-industry wage structure. *Econometrica*, LVI: 259-93.

Lelarge, Claire 2009, Alleviating the burden of entrepreneurial risk? Evidence from two French targeted programs, report to the Direction Générale des Entreprises, Service des Études et Statistiques Industrielles.

Lokshin, Boris and Pierre Mohnen, 2007. Measuring the Effectiveness of R&D Tax Credits in the Netherlands, UNU-MERIT Working Paper Series number 025.

Lokshin, Boris and Pierre Mohnen, 2012. How effective are level-based R&D tax credits? Evidence from the Netherlands, *Applied Economics,* 44(12): 1527-1538.

Marey, Peter and Lex Borghans. 2000. Wage elasticities of the supply of R&D workers in the Netherlands, mimeo, ROA, University of Maastricht.

Mellow, Wesley. 1982. Employer size and wages. *Review of Economics and Statistics* 64: 495-501.

Nekby, Lena. 2003. Gender differences in rent sharing and its implications for the gender gap, evidence from Sweden. *Economics Letters* 81: 403-10.

Organisation for Economic Cooperation and Development. 2009. OECD Science, Technology and Industry Scoreboard. Paris.

Romer, Paul. 2000. Should the government subsidize supply or demand in the market for scientists and engineers?, NBER working paper 7723.

Salinger, Michael. 1984. Tobin's Q, unionization and the concentration-profits relationship. *RAND Journal of Economics* 15: 159-70.

Sap, Jolande. 1993. Bargaining power and wages: A game-theoretic model of gender differences in union wage bargaining. *Labour Economics* 1: 25-48.

Solon, Gary, Robert Barsky and Jonathan Parker. 1994. Measuring the cyclicality of real wages: how important is composition bias? *Quarterly Journal of Economics* 109: 1-26.

Stock, J. and M. Yogo, 2005. Testing for weak instruments in linear IV regression. In Identification and Inference for Econometric Models: Essays in Honor of Thomas Rothenberg, ed. D.W.K. Andrews and J.H. Stock, 80-108. Cambridge: Cambridge University Press.

Üçdoğruk, Yesim, 2004. Do researchers benefit from R&D support programs in Turkey?, Paper presented at the 10th SMYE Conference, Geneva, Switzerland.

Vandenbussche, Hylke, Reinhilde Veugelers, Josef Konings. 2001. Unionization and European antidumping protection. *Oxford Economic Papers* 53: 297-317.

Van Reenen, John. 1996. The creation and capture of rents: wages and innovation in a panel of U.K. companies. *Quarterly Journal of Economics* 111(1): 195-226.

Veugelers, Reinhilde. 1989. Wage premia, price-cost margins and bargaining power in Belgian manufacturing. *European Economic Review* 33: 169-180.

Wolff, Guntrm B. and Reinthaler, Volker. 2008. The effectiveness of subsidies revisited: accounting for wage and employment effects in business R&D. *Research Policy* 37: 1403-1412.

Table 1 Overview of the fiscal incentives scheme parameters

Year	Program budget (in mln. Euro)	Length of the first bracket (in Euro)	% First bracket rate	% Second bracket rate	Ceiling (in mln. Euro)
1996	253	68067	40	12.05	4.5
1997	274	68067	40	12.5	6.8
1998	372	68067	40	17.5	6.8
1999	353	68067	40	13	6.8
2000	365	68067	40	13	6.8
2001	435	90756	40 or 60 (s)	13	7.9
2002	464	90756	40 or 70 (s)	13	7.9
2003	425	90756	40 or 60 (s)	13	7.9
2004	466	110000	40 or 60 (s)	14	7.9

Table 2 Variable constructions and descriptive statistics

Variable	Construction	Mean	Standard Deviation
Variables at the firm level			
Wage rate	Total wage bill divided by the number of hours	21.58	12.15
Capital-labor ratio	Capital stock divided by the number of employees (in 1000 Euros per employee)	12.86	19.12
Firm size	Number of employees	290.82	567.55
Effective R&D tax credit rate	Percent of R&D labor cost supported by government, computed as in (A1)	0.24	0.09
Variables at the industry level			
Alternative wage	Average sector R&D wage rate	23.44	2.93
Investment potential: solvability	Average solvability at industry level	36.14	11.21
Investment potential: return	Average return on total assets at industry level	2.75	7.37
Perceived competition	Index scaled between 0 (perceived competition is very low) and 100 (very high). Mean perception of competition by entrepreneurs at industry level	45.60	2.06
Turbulence	Ratio of new entrants over exits and spin-offs at industry level	11.60	3.20
Turnover	Annual mutation of added value at industry level	6.44	3.71

Note: The descriptive statistics are sample means for the years 1997-2004. The industry level data other than the alternative wage were provided to us by EIM.

Table 3 Static and dynamic estimates of the wage equation (2)

	Rate of R&D tax credit treated as exogenous		Rate of R&D tax credit treated as endogenous	
	OLS on pooled data	With firm fixed effects (within)	IV with firm fixed effects (within)	System GMM
Dependent variable	Log(Wage rate)	Log(Wage rate)	Log(Wage rate)	Log(Wage rate)
	(1)	(2)	(3)	(4)
Effective rate of R&D tax credit	0.058** (0.013)	0.159*** (0.001)	0.210*** (0.050)	0.188*** (0.045)
Capital-labor ratio * 10^{-2}	0.002*** (0.000)	0.001*** (0.000)	0.001 (0.001)	0.002* (0.001)
Firm size (in logs)	0.045***	0.031* (0.018)	0.031* (0.018)	0.045*** (0.008)
Alternative wage	-0.001 (0.002)	0.100 (0.062)	0.097* (0.058)	0.002 (0.055)
Lagged wage rate	-	-	-	0.207*** (0.054)
Business cycle controls	Included	Included	Included	Included
Industry dummies	Included	-	-	Included
R^2	0.23	0.24	0.23	-
F-test of significance of individual effects	-	5.97 (0.00)	4.77 (0.00)	-
F-test of Shea's partial R^2 of instruments	-	-	833.10 (0.00)	-
Sargan/Hansen test (p-value)	-	-	1.32 (0.25)	62.01 (0.14)
AR (1) test, (p-value)	-	-	-	-6.52 (0.00)
AR (2) test, (p-value)	-	-	-	0.95 (0.34)
No. of firms	873	873	873	873
No. of observations	3245	3245	3245	3245

Notes: Estimation period is 1997-2004. Robust standard errors (clustered at the level of firm) are in parentheses. All models include time dummies.
*** Indicates significance at 1%, ** at 5%, * at 10% level.

Appendix A: Construction of the effective R&D tax credit in the Netherlands

The Dutch fiscal incentives scheme (WBSO) is a contribution towards R&D labor costs. Firms are entitled to a reduction in social security contributions for the R&D labor cost. The scheme has two brackets and a ceiling. The parameters of this program are given in table 1.We measure the effective R&D tax credit for firm i , d_{it}^{R} , by the fraction of the private R&D labor expenditure that is supported by the tax incentive program. It is given by the following expression

$$d_{it}^{R} = D_{1it}\left[a_{it} \min\left(\frac{R_{Lit}^{1}}{w_{it}^{L} R_{it}}, 1 \right) + c_{it}\omega_{it}^{2} \min\left(1 - \frac{R_{Lit}^{1}}{w_{it}^{L} R_{it}}, \frac{(R_{Lit}^{2} - a_{it} R_{Lit}^{1}) / \omega_{it}^{2}}{w_{it}^{L} R_{it}} \right) \right]. \qquad \text{(A1)}$$

where

$a_{it} = \omega_{1it}^{1}(1 - D_{2it}) + \omega_{2it}^{1} D_{2it}$

$c_{it} = 1$ if $w_{it}^{L} R_{it} > R_{Lit}^{1}$, else $c_{it} = 0$

w_{it}^{L} = percentage of labor costs in total R&D

$D_{1it} = 1$ if R&D is eligible

$D_{2it} = 1$ if the starters facility regulation can be applied

ω_{1it}^{1} : first bracket rate for firms non eligible for the starters facility regulation

ω_{2it}^{1} : first bracket rate for firms eligible to the starter's facility regulation

ω_{it}^{2} : second bracket rate, which is the same for starters and non-starters

R_{Lit}^{1} : first bracket ceiling (in terms of deductible R&D labor costs)

R_{Lit}^{2} : second bracket ceiling (in terms of reduced labor taxes)

Appendix B: First stage estimates of the effective rate of R&D tax credit d_{it}^{R} in column (3) of table 3

Dependent variable	Log(effective rate of R&D tax credit)
d_{it}^{IVFE}	0.210*** (0.050)
R&D deflator	-0.079* (0.045)
Capital-labor ratio * 10^{-2}	-0.001 (0.001)
Firm size (in logs)	-0.052* (0.021)
Alternative wage	0.089 (0.071)
Business cycle controls	Included
R^2	0.61
F-test (17, 2355)	160.59
No. of firms	873
No. of observations	3245

Appendix C: Reduced form estimation of the wage equation (2) with the excluded instrumental variables

Dependent variable	Log(Wage rate)
d_{it}^{IVFE}	0.171*** (0.044)
R&D deflator	-0.052* (0.030)
Capital-labor ratio * 10^{-2}	0.001 (0.002)
Firm size (in logs)	0.019 (0.021)
Alternative wage	0.112 (0.058)
Business cycle controls	Included
R^2 (within)	0.24
No. of firms	873
No. of observations	3245

The UNU-MERIT WORKING Paper Series

2012-01 *Maastricht reflections on innovation* by Luc Soete
2012-02 *A methodological survey of dynamic microsimulation models* by Jinjing Li and Cathal O'Donoghue
2012-03 *Evaluating binary alignment methods in microsimulation models* by Jinjing Li and Cathal O'Donoghue
2012-04 *Estimates of the value of patent rights in China* by Can Huang
2012-05 *The impact of malnutrition and post traumatic stress disorder on the performance of working memory in children* by Elise de Neubourg and Chris de Neubourg
2012-06 *Cross-national trends in permanent earnings inequality and earnings instability in Europe 1994*-2001 by Denisa Maria Sologon and Cathal O'Donoghue
2012-07 *Foreign aid transaction costs* by Frieda Vandeninden
2012-08 *A simulation of social pensions in Europe* by Frieda Vandeninden
2012-09 *The informal ICT sector and innovation processes in Senegal* by Almamy Konté and Mariama Ndong
2012-10 *The monkey on your back?! Hierarchical positions and their influence on participants' behaviour within communities of learning* by Martin Rehm, Wim Gijselaers and Mien Segers
2012-11 *Do Ak models really lack transitional dynamics?* by Yoseph Yilma Getachew
2012-12 *The co-evolution of organizational performance and emotional contagion* by R. Cowan, N. Jonard, and R.Weehuizen
2012-13 *"Surfeiting, the appetite may sicken": Entrepreneurship and the happiness of nations* by Wim Naudé, José Ernesto Amorós and Oscar Cristi
2012-14 *Social interactions and complex networks* by Daniel C. Opolot
2012-15 *New firm creation and failure: A matching approach* by Thomas Gries, Stefan Jungblut and Wim Naudé
2012-16 *Gains from child-centred Early Childhood Education: Evidence from a Dutch pilot programme* by Robert Bauchmüller
2012-17 *Highly skilled temporary return, technological change and Innovation: The Case of the TRQN Project in Afghanistan* by Melissa Siegel and Katie Kuschminder
2012-18 *New Technologies in remittances sending: Opportunities for mobile remittances in Africa* Melissa Siegel and Sonja Fransen
2012-19 *Implementation of cross-country migration surveys in conflict-affected settings: Lessons from the IS Academy survey in Burundi and Ethiopia* by Sonja Fransen, Katie Kuschminder and Melissa Siegel
2012-20 *International entrepreneurship and technological capabilities in the Middle East and North Africa* by Juliane Brach and Wim Naudé
2012-21 *Entrepreneurship, stages of development, and industrialization* by Zoltan J. Ács and Wim Naudé
2012-22 *Innovation strategies and employment in Latin American firms* by Gustavo Crespi and Pluvia Zuniga
2012-23 *An exploration of agricultural grassroots innovation in South Africa and implications for innovation indicator development* by Brigid Letty, Zanele Shezi and Maxwell Mudhara
2012-24 *Employment effect of innovation: microdata evidence from Bangladesh and Pakistan* by Abdul Waheed

2012-25 *Open innovation, contracts, and intellectual property rights: an exploratory empirical study* by John Hagedoorn and Ann-Kristin Ridder
2012-26 *Remittances provide resilience against disasters in Africa* by Wim Naudé and Henri Bezuidenhout
2012-27 *Entrepreneurship and economic development: Theory, evidence and policy* by Wim Naudé
2012-28 *Whom to target - an obvious choice?* by Esther Schüring and Franziska Gassmann
2012-29 *Sunk costs, extensive R&D subsidies and permanent inducement effects* by Pere Arqué-Castells and Pierre Mohnen
2012-30 *Assessing contingent liabilities in public-private partnerships (PPPs)* by Emmanouil Sfakianakis and Mindel van de Laar
2012-31 *Informal knowledge exchanges under complex social relations: A network study of handloom clusters in Kerala, India* by Robin Cowan and Anant Kamath
2012-32 *Proximate, intermediate and ultimate causality: Theories and experiences of growth and development* by Adam Szirmai
2012-33 *Institutions and long-run growth performance: An analytic literature review of the institutional determinants of economic growth* by Richard Bluhm and Adam Szirmai
2012-34 *Techniques for dealing with reverse causality between institutions and economic performance* by Luciana Cingolani and Denis de Crombrugghe
2012-35 *Preliminary conclusions on institutions and economic performance* by Denis de Crombrugghe and Kristine Farla
2012-36 *Stylized facts of governance, institutions and economic development. Exploring the institutional profiles database* by Bart Verspagen
2012-37 *Exploring the Panel Components of the Institutional Profiles Database (IPD)* by Luciana Cingolani and Denis de Crombrugghe
2012-38 *Institutions and credit* by Kristine Farla
2012-39 *Industrial policy for growth* by Kristine Farla
2012-40 *Explaining the dynamics of stagnation: An empirical examination of the North, Wallis and Weingast approach* by Richard Bluhm, Denis de Crombrugghe and Adam Szirmai
2012-41 *The importance of manufacturing in economic development: Past, present and future perspectives* by Wim Naudé and Adam Szirmai
2012-42 *Lords of Uhuru: the political economy of elite competition and institutional change in post-independence Kenya* by Biniam Bedasso
2012-43 *Employment and wages of people living with HIV/AIDS* by Pilar García-Gómez, José M. Labeaga and Juan Oliva
2012-44 *Prescriptions for network strategy: Does evidence of network effects in cross-section support them?* by Joel A.C. Baum, Robin Cowan and Nicolas Jonard
2012-45 *Perspectives on human development theory in democracy promotion: A comparison of democracy promotion programmes in Egypt through the lenses of classical and revised modernisation theory* by Inger Karin Moen Dyrnes
2012-46 *Nonlinearities in productivity growth: A semi-parametric panel analysis* by Théophile T. Azomahou, Bity Diene and Mbaye Diene
2012-47 *Optimal health investment with separable and non-separable preferences* by Théophile T. Azomahou, Bity Diene, Mbaye Diene and Luc Soete
2012-48 *Income polarization and innovation: Evidence from African economies* by Théophile T. Azomahou and Mbaye Dien

2012-49 *Technological capabilities and cost efficiency as antecedents of foreign market entry* by Fabrizio Cesaroni, Marco S. Giarratana and Ester Martínez-Ros

2012-50 *Does the internet generate economic growth, international trade, or both?* by Huub Meijers

2012-51 *Process innovation objectives and management complementarities: patterns, drivers, co-adoption and performance effects* by Jose-Luis Hervas-Oliver, Francisca Sempere-Ripoll and Carles Boronat-Moll

2012-52 *A systemic perspective in understanding the successful emergence of non-traditional exports: two cases from Africa and Latin America* by Michiko Iizuka and Mulu Gebreeyesus

2012-53 *Determinants of quadic patenting: Market access, imitative threat, competition and strength of intellectual property rights* Can Huang and Jojo Jacob

2012-54 *Envy and habits: Panel data estimates of interdependent preferences* by Jose Maria Casado, Francisco Alvarez-Cuadrado, Jose Maria Labeaga and Dhanoos Sutthiphisal

2012-55 *The impact of Medium-Skilled immigration: A general equilibrium approach* by Joan Muysken, Ehsan Vallizadeh and Thomas Ziesemer

2012-56 *Tax incentives or subsidies for R&D?* by Isabel Busom, Beatriz Corchuelo and Ester Martinez Ros

2012-57 *The impact of development aid on education and health: Survey and new evidence from dynamic models* by Thomas Ziesemer

2012-58 *Do R&D tax incentives lead to higher wages for R&D workers? Evidence from the Netherlands* by Boris Lokshin and Pierre Mohnen